# Transaction Costs and Agricultural Household Supply Response of Maize Farmers in Ogbomoso Agricultural Zone of Oyo State

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**Abstract**

This research was an attempt to determine the magnitude and the direction to which the level of transaction costs influence changes in maize supply in the study area. Multi-stage random sampling technique was employed to select 110 maize producing farmers for the study. Data for the study were collected using structured interview schedule and analyzed using descriptive statistics and estimation of Cobb-Douglas regression model. The result showed that mean age for respondents was 45.8 years while more than half of them were literates. The major source of finance for the farmers was personal savings while the mean land area cultivated was 2.1 ha. The results of the regression analysis showed that significant relationships exist between transaction costs and agricultural household supply response in the study area. The average fixed and proportional transaction costs were ₦ 2960.82 and ₦ 15906.58, respectively.



## 1. Introduction

Food insecurity is generally associated with fluctuation in household's own food production and food prices. Household food security refers to a household's ability to acquire food. A country and people are food secured when their food system operates in such a way as to remove the fear that there will not be enough to eat. In particular, food security will be achieved when those living in marginal areas have secured access to food they want (Maxwell and Fronkenberger, 1992).

Nigeria, as a developing country, has expanding population both in the urban and rural areas. The population growth rate is 3.5% annum$^{-1}$, while the food production rate is 2.5% annum$^{-1}$ (Ajibefun, 1998). The significant imbalance between food production and the expanding population has resulted in an ever-increasing demand for agricultural products. It has also placed a serious stress on the marketing systems (Ojo and Imoudu, 2000). Food security is jointly determined by availability of food and accessibility to the food. Availability of food is a function of food production, stock holding and food marketing (Von Braun et al., 1992). Certainly by raising agricultural productivity, i.e. increasing the land area planted and increasing yield ha$^{-1}$, food availability could be increased. However, availability is not enough. The food produced must be distributed efficiently at minimum costs in order to guarantee continuous availability of the food. This is the subject of food marketing. Olayemi (1982) observed that food marketing is a very important but rather neglected aspect of agricultural consideration on how to distribute the food produced efficiently and in a manner that will enhance increased productivity. In other words, food marketing by farmers and their families, mostly in the immediate post-harvest period usually involves a lot of costs and in Nigeria these costs are so high that lowering the costs through efficient marketing system may be as important as increasing agricultural production. Subsequently, Ladele and Ayoola (1997), in their study on 'Food marketing and its role in food security in Nigeria', concluded that an efficient food marketing system would reduce post-harvest losses, ensure adequate returns to farmers' investment, and stimulate expansion in food production thereby enhancing the level of food security in Nigeria.

Transaction costs refer to the costs of measuring the valuable attributes of the commodity exchanged and the costs of providing and ensuring the desired attributes (North, 1990). These costs are associated with the costs of providing for some goods or services through the market rather than having it provided from within the farm. In order to carry out a market transaction it is necessary to discover who is it that one wishes to deal with, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on. Transaction costs are generally grouped into proportional and fixed transaction costs. There has been little work examining agricultural supply response that takes into account both the farmers' production and market participation decisions. Most of the previous research focuses on price and its effect on agricultural supply response. Ajetomobi et al. (2006) carried out a supply analysis for food crops in Oyo state but only considered own price factor. Krishna (1967) looked at agricultural price policy and economic development. Askari and Cummings (1977) looked into agricultural supply response to price while Mamingi (1997) measured the

impact of prices and macro-economic policies on agricultural supply. Odunuga (1988) looked at acreage response to prices in small scale food crop agriculture in Oyo state. Murova et al. (2001) and Leaver (2003) measured responsiveness of agricultural output for Ukrainian and Zimbabwean farmers, respectively to price but did not consider any market factors. Chibber (1988) worked on raising agricultural output through price and non-price factors but never took into account any market factor. Goetz (1992) differs from the above. He uses a selectivity model in which marketed surplus is estimated conditional on market participation. The market participation was estimated using a reduced form equation. A similar study carried out on Mexican farmers suggested that the issue of transaction costs creates a situation where some producers buy, others sell, and others do not participate in markets (Key et al., 2000).

The bulk of the available research work on agricultural supply response that takes into account both the farmers' production and market participation decisions is mainly based on countries outside Nigeria. For this reason, policy makers may need to be careful in the application of their recommendations to development of agriculture at the grass root given a broad consensus among economists that improvements in both transport and institutional arrangements are important. This necessitates the need to look critically into the Nigerian marketing system with the aim of identifying variables associated with transaction costs and to determine relative importance of such factors in influencing farmers' decision making in relation to market participation and output supply. The main objective of this work therefore was to determine the magnitude and the direction to which the level of transaction costs influence changes in maize supply in the study area.

The focus on maize farmers derives from the fact that maize is one of the important grains in Nigeria both on the basis of the number of farmers who engaged in its cultivation, and also in its economic value. Maize is a multipurpose crop because every part of its plant has economic value. The grain, leaves, stalk, tassel and cob can all be used to produce a large variety of food and non-food products (IITA, 2001). Although maize is increasingly being utilized for livestock feed, it is still a very important staple food for millions of Nigerians.

As a result of competition for maize by both man and animal, there is the need to increase the supply level of the grain. Growing maize in farms of 1-2 ha can overcome hunger in the household and the aggregate effect could double the food production in Africa. In trend projections of consumption and production of major food crops in sub-Saharan Africa to the year 2000 (Von Braun, 1991), production was put at 110 mt while consumption was put at 161 mt, creating a deficit of 51 mt. Specifically, for west Africa, production was put at 42 mt while consumption was put at 76 mt, creating a deficit of 34 mt.

It is therefore with the hope of detecting relevant market factors that could serve as incentives for agricultural households to increase their present level of maize supply in an effort to bridge the gap between production and consumption this study was carried out.

## 2. Materials and Methods

This study was carried out in Ogbomoso agricultural zone of Oyo state. Ogunbodede and Olakojo (2001) showed that Oyo and Osun states produce about 50% of maize produced in the south-western part of Nigeria. Ogbomoso shares its boundaries to the north, east, south and west with Ilorin, Osogbo, Oyo and Igbeti, respectively. It is located between latitude 70°N and longitude 2°47' and 40°E. The mean annual temperature is 27°C. Oyo state produces an average of 171,666.67 t of maize cropping$^{-1}$ season (FAO, 2006).

The population of the study comprises all registered maize producing farmers in Ogbomoso area of Oyo state in Nigeria. Oyo State Agricultural Development Project has divided the state into 4 agricultural zones and 28 blocks for administrative convenience. The agricultural zones are Ibadan/Ibarapa (9 blocks), Ogbomoso (5 blocks), Oyo (5 blocks) and Saki (9 blocks). A multi-stage random sampling technique was employed to sample 110 maize producing farmers. In the first stage, Ogbomoso zone was purposively selected. In the second stage, two blocks (40%) were randomly selected. Each block comprised eight cells, making a total of 16 cells for the study. Thereafter in the third stage, 40% of the farmers' groups were selected at random. Finally, 20% of the maize farmers in each group were randomly sampled for the study. Thus, a total of 110 maize farmers formed the sample of the study. A structured interview schedule was used to collect primary data from sampled maize farmers. The questions were designed to collect information on socio-economic characteristics of respondents, production and marketing practices and experience, quantity of produce supplied to the market and factors determining such quantity. Age of respondents, production and marketing experience were measured in years. Costs and prices were valued in Naira (₦). Cultivated area of land was measured in ha while output was measured in kg.

### *2.1. Regression model*

Deriving from the foregoing theoretical framework, the model employed for the study is as follows:

$$\text{Log } Q = b_o + b_1 \text{ Log } P + b_2 \text{ Log } A + b_3 \text{ Log NEGO} + b_4 \text{ Log AGENTS} + b_5 \text{ Log HARVEST} + b_6 \text{ Log ASSEMBLAGE} + b_7 \text{ Log STORAGE} + b_8 \text{ Log TRANSPORT} + b_9 \text{ Log RENT}$$

$$b_1 > O,\ b_2 > O,\ b_3 < O,\ b_4 < O,\ b_5 < O,\ b_6 < O,\ b_7 < O,\ b_8 < O,\ b_9 < O$$

Where:

Q=Quantity of maize supplied (kg)
A=Area of land cultivated with maize (ha)
P=Market price for maize (₦)
Harvest=Harvest cost (₦)
Storage=Storage cost (₦)
Transport=Cost of transport (₦)
Assemblage=Assemblage cost (₦)
Nego=Negotiation/Bargaining cost (₦)
Agents=Agents' fee (₦)

Rent=Transactions land rent (₦)

$b_0$=Constant

$b_1$ … $b_9$ represent coefficient values of independent variables and ε=error term.

The a priori expectations were based mainly on economic theory (the law of supply) and empirical findings from literature reviewed. It was expected that transaction cost and quantity of maize supplied would be inversely related. The error term is conceived as both involving measurement error in the dependent variable (but not in the independent variables) and being a resultant of all the various causes of the dependent variable that have not been explicitly brought into the equation.

## 3. Results and Discussion

### *3.1. Socio-economic characteristics of respondents*

The summary of the descriptive analysis of the farmers' socio-economic characteristics are shown in Table 1. The mean age for the sampled farmers was 45.8 years. This portrays that most of the maize farmers are in their active and productive age when they can put in their best for optimum productivity. The summary of sex distribution revealed that 70.9% of the respondents are male. The result showed that 17.7% of the respondents had no formal education at all, while 29.5% of them had tertiary education. This result suggests that more than half of the respondents were literate. About 93% of the interviewed farmers were married while 4.5% were single. The mean household size for respondents was 8. The result revealed that 23.6% of the respondents claimed maximum of 5 members in household, while the largest percentage (73.2%) had between 6-10 household members.

The table contains the distribution of sampled farmers based on major source of finance. The result showed that 63.6% of respondents depended on personal savings in financing their maize production activities while only 3.7% claimed to depend on bank loans. Most of the respondents claimed they would have loved to have access to government or bank loans but lacked required collateral. Reliance of most of them on personal savings results in inability to produce on large scale, if so desired.

Table 1: Socio-economic characteristics of respondents

| Age (years) | Frequency | Percentage | Household size | Frequency | Percentage |
|---|---|---|---|---|---|
| 20-29 | 7 | 5.9 | ≤5 | 26 | 23.7 |
| 30-39 | 15 | 13.6 | 6-10 | 80 | 72.7 |
| 40-49 | 55 | 50.5 | 11-15 | 2 | 1.8 |
| 50-59 | 29 | 26.8 | 16-20 | 2 | 1.8 |
| 60 and above | 4 | 3.2 | Total | 100 | 100 |
| Total | 110 | 100 | Major source of finance | Frequency | Percentage |
| Level of education | Frequency | Percentage | Personal savings | 70 | 63.6 |
| No formal education | 20 | 18.1 | Friends and relatives | 4 | 3.6 |
| Primary education | 28 | 25.5 | LG/STATE/FADAMA LOAN | 1 | 0.9 |
| Secondary education | 20 | 18.1 | Cooperative loan | 31 | 28.3 |
| Tertiary education | 32 | 29.1 | Bank loan | 4 | 3.6 |
| Adult education | 9 | 8.2 | Total | 110 | 100 |
| Islamic education | 1 | 0.9 | Year of experience | Frequency | Percentage |
| Total | 110 | 100 | 1-10 | 28 | 25 |
| Marital status | Frequency | Percentage | 11-20 | 47 | 43.2 |
| Single | 5 | 4.5 | 21-30 | 23 | 20.9 |
| Married | 102 | 92.7 | 31-40 | 12 | 10.9 |
| Widow(er) | 3 | 2.7 | Farm size (ha) | Frequency | Percentage |
| Total | 110 | 100 | <2 | 54 | 49.1 |
| Source: Field survey, 2009 (Primary data obtained from the respondents) | | | 2-5 | 44 | 40 |
| | | | >5 | 12 | 10.9 |
| | | | Total | 110 | 100 |

The table summarizes the distribution of sampled farmers according to years of experience in maize production. The mean value was 16.8 years. The table groups the respondent farmers according to farm size. Mean value was 2.1 ha for the respondents. This could be as a result of low accessibility to

land and formal loans. The result obtained shows that most of the respondents are small scale farmers. According to Aliyu and Shaib's (1997) classification, Nigerian farmers fall into three broad categories, namely, small scale with 0.10 to 5.99 ha, medium scale with 6 to 9.99 ha and large scale holdings with 10 ha upward. The finding is in agreement with Odunuga (1988) and Azih (2004).

Table 2 shows the minimum, maximum, mean, and standard deviation and variance values of transaction variables for the respondents.

*3.2. Regression result for respondents*

The Cobb-Douglas functional form linearised by log transformation was specified to analyze the supply response of respondents. As could be seen from the result (Table 3), the $R^2$ was 0.886. This means that 88.6% of the variation in the dependent variable (Q) was explained by its association with the independent variables. The F-value was 85.414 and significant at 1%. This means that the null hypothesis should be rejected and the alternative hypothesis accepted. As such, there is a significant relationship between quantity of maize supplied and the explanatory variables.

The result revealed that, six variables out of the estimated nine were found to be statistically significant in relation to quantity supplied decisions made by agricultural households. They are: market price of maize, land area cultivated to maize, and assemblage cost, which have proportional relationship with quantity of maize supplied by respondents; as well as negotiation cost, transactions land rent and transportation cost which have inverse relationship with quantity of maize supplied.

Table 2: Distribution of respondents' transaction variables

| Transaction variables | Minimum | Maximum | Mean | Standard deviation | Variance |
|---|---|---|---|---|---|
| Harvesting cost | 720 | 51480 | 5143.94 | 3334.746 | 11120529 |
| Assemblage cost | 120 | 8580 | 929.20 | 573.199 | 328556.86 |
| Storage cost | 360 | 27440 | 2798.06 | 1857.502 | 3450313.3 |
| Negotiation/Bargaining cost | 230 | 6220 | 761.66 | 434.677 | 188944.31 |
| Agents fee | 300 | 7780 | 956.78 | 546.069 | 298190.81 |
| Transportation cost | 960 | 68540 | 7035.38 | 4604.020 | 21196667 |
| Transactions land rent | 300 | 10360 | 1242.38 | 729.800 | 532607.42 |
| Price $kg^{-1}$ | 40 | 65 | 49.69 | 5.701 | 32.500 |
| Quantity of maize | 440 | 50000 | 2958.44 | 5695.922 | 32443530 |

Source: Field survey, 2009 (Primary data obtained from the respondents)

Table 3: Regression result showing statistical relationship between variables

| Independent variable | Coefficient | t-value |
|---|---|---|
| Constant term | 5.655 | 17.884 |
| Log (P) | 1.360E-02 | 1.966* |
| Log (A) | 0.694 | 18.865*** |
| Log NEGO | -5.608E-03 | -2.890** |
| Log AGENT | -1.951E-03 | -1.073 |
| Log HARVEST | -3.170E-04 | -0.681 |
| Log ASSEMBLAGE | 2.439E-03 | 2.636** |
| Log STORAGE | 7.592E-04 | 1.048 |
| Log TRANSPORT | -3.039E-04 | -3.139** |
| Log RENT | -1.676E-03 | -1.835* |
| Adjusted $R^2$ | 0.886 | |
| F | 85.414 | |

Source: Field survey, 2009 (Primary data obtained from the respondents); ***Significant at 1%, **Significant at 5%, *Significant at 10%; Dependent variable=Q, n=110

The result in relation to market price of maize is in line with the a priori expectations of the study and it corresponds with findings from empirical results of other related studies reviewed in the course of this study. These include Stifel et al. (2003), Murova et al. (2001), Oni (2000), MacInnis (2003) and Key et al. (2000). Leaver (2003) however found that Zimbabwean tobacco farmers are relatively unresponsive to output prices.

The quantity of maize supplied was found to have an inverse (negative) relationship with negotiation cost, transactions land rent and transportation cost. This finding corresponds with the a priori expectation of the study and also with the findings of Minot (1999) and Stifel et al. (2003) that transaction costs decrease market surplus. Maize quantity supplied was found to have an inverse significant relationship with transactions land rent. Transactions land rent includes all the toll and local government fees paid by suppliers. The finding corresponds with the study's a priori expectation as well as Minot (1999) and Key et al. (2000) empirical results that transaction costs negatively affect agricultural household supply response.

Contrary to empirical results from Hobbs (1997), Key et al. (2000), Stifel et al. (2003) and MacInnis (2003), analysis of the data revealed agents fee, harvesting cost and storage cost to be statistically insignificant to quantity of maize supplied by agricultural households in the study area.

*3.3. Elasticity of supply response for respondents*

The result showed that with respect to price, area, negotiation

cost, agents' fee, harvesting cost, assemblage cost, storage cost, transportation cost and transactions land rent, a 10% change in each of the variables will lead to 0.14%, 6.94%, 0.06%, 0.02%, 0.003%, 0.02%, 0.008%, 0.003% and 0.02% change in quantity of maize supplied by the respondents, respectively. In this case, agricultural households supply response is highly elastic with respect to land area cultivated. There are also elements of elasticity with respect to other variables.

This finding compares with the finding of Bond who estimated output elasticity of sub-Saharan Africa, and reported that price elasticity ranges from 0.1 to 0.5 in the short run and from 0.6 to 1.8 in the long run. Also in Shumway and Lim's (1993) study, the own-price elasticity for crops was 0.42. Oni (2000) also reported that empirical studies on crop price responsiveness in less developed countries have shown that price elasticity for staple food crops range from 0.0 to 0.4. Key et al. (2000) found that the net effect of an increase in the selling price is an increase in output by 0.5%.

The major findings of the study were as follows:

- Variables associated with transaction costs in the study area include harvesting, assemblage, storage, transportation to the point of sale, negotiation/bargaining, agents' fee and transactions land rent.
- Land area cultivated (ha) is a very important non-market factor affecting supply in the study area.
- The $R^2$ for the regression analysis of pooled data was 0.886. It means that 88.6% of variations in quantity of maize supplied by the respondents in the study area were explained by the estimated independent variables.
- There were significant inverse relationships between transaction costs and quantity of maize supplied by respondents in the study area.
- There were significant positive relationships between quantity of maize supplied by respondents in the study area and size of land area cultivated as well as market price of maize.

## 4. Conclusion

From the study it could be concluded that:

- Maize supply responds to transaction costs in the study area in that coefficients of transaction costs were statistically significant.
- Maize supply responds positively to market price and area of land cultivated in the study area.
- Market factors as well as non-market factors significantly affect agricultural household supply response in the study area.

Based on the finding of this study that agricultural households respond to transaction costs in making maize supply decisions in the study area, policies that reduce transaction costs will consequently complement price policies in affecting supply response. The quality of road infrastructure should be improved as this is expected to reduce transport costs significantly. At the same time, the effects of institutional deficiencies on the functioning of markets should be addressed. Proper market institutions reduce transaction costs as lower fees charged by local government authorities as well as toll fee collected from supplier will reduce transactions land rent. The government officials and those that had been appointed to look after the affairs of he local markets should look into this. Based on the finding that both price and structural factors (with particular reference to land area) significantly affect agricultural household supply decisions in the study area, the policy implications of this is that to serve as compliments to various price policies being made and implemented by the government, there is the need to improve land scheme, credit scheme (rural finance), pricing and distribution of inputs.

Agricultural households too should strengthen themselves financially by forming cooperative groups whereby members could have access to loans at a very low rate and farm inputs could be purchased in bulk to be shared among members at a reduced cost. The produce could also be sold in bulk, thereby lowering the average transaction costs.

## 5. Further Research

The research recommends for further study in other parts of the country by future interested researchers. Corporate bodies and agricultural institutes in Nigeria should take up this challenge so that relevant panel and time series data could be generated over time for a more rigorous and in-depth study that could give a clearer effect of transaction costs on agricultural household supply response in Nigeria.

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